File: I-5231.B21 (29, B-1)

(Not for Publication)

Dispose after circularizing.
Retain for ..... years.
Library
File
Other disposition

March 1969

STUDY PLAN FOR SAMPLING THE DOUGLAS-FIR BEETLE, *DENDROCTONUS PSEUDOTSUGAE* HOPK., IN THE NORTHERN REGION

U.S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
Division of State and Private Forestry
Northern Region

Missoula, Montana

5200

STUDY PLAN FOR SAMPLING THE DOUGLAS-FIR BEETLE, DENDROCTONUS PSEUDOTSUGAE HOPK., IN THE NORTHERN REGION

By

Mark D. McGregor, Entomologist
Forest Insect and Disease Branch

INTRODUCTION

The Douglas-fir beetle, Dendroctonus pseudotsugae Hopk., is, without exception, the most destructive bark beetle of Douglas-fir, Pseudotsuga menziesii (Mirb.) Franco, throughout the western United States and Canada. Populations of this beetle can fluctuate yearly and local outbreaks are common. This insect prefers weakened trees, recent windthrows, or stumps and slash rather than healthy trees. If favorable host material is abundant, populations generally increase. When populations reach epidemic proportions, and sufficient slash and/or windthrow isn't available, attacks are concentrated on green trees.

The interior Douglas-fir type extends over a greater area and supports more sawtimber volume than any other major forest type. Douglas-fir comprises 25 percent of the timber type, and includes 25 percent of the total volume of sawtimber in Region 1. Douglas-fir is second only to lodgepole pine and western white pine in total timber type in Region 1.[1/]

Problems in Evaluating Douglas-fir Beetle

Several problems are encountered in Douglas-fir beetle evaluations which should be taken into consideration before accurate predictions can be made. These include:

1. Large brood densities do not necessarily indicate a high rate of tree mortality. Chance occurrence of massive windthrow can attract the majority of the emerging population and small losses of live standing trees occur. If the presence of fresh windthrow were known, a revised forecast would be possible.

2. Entire beetle populations sometimes fail to emerge due to apparent cumulative effects of cool weather and other biological factors which may extend over several generations. Broods can develop out of synchronization with the normal seasonal history. This condition occurred on the Dixie National Forest in southern Utah in 1962.[2/]

1/ Evans, Sam. Personal communication. 1968.

2/ Furniss, Malcolm M. An instance of delayed emergence of the Douglas-fir beetle and its effect on an infestation in southern Utah. Jour. Econ. Ent. 58(3) 440-442. 1965.

3. Trees can be killed by an extremely variable number of beetles. Thus, brood densities are not necessarily proportioned to number of trees that may be killed by the next generation. This is further compounded since individual trees may vary their "tolerance" to beetle attack from year to year.

4. Losses of a population during beetle flight may be influenced by weather. The daily fluctuations during the emergence period could have a profound effect on success of attacks and number of trees killed.

Purpose of study.--This study is initiated for the following reasons: (1) the Douglas-fir beetle is a chronic problem throughout Douglas-fir stands of the Northern Region, (2) a satisfactory method of predicting infestation trends is not available, and (3) data collected would aid in developing a sequential sampling method that would benefit biological evaluations by saving time and increasing accuracy in predicting trends.

Objective.--The objective of this study is: To determine if any brood stage of the Douglas-fir beetle can be used to predict infestation trends.

Methods and procedures.--Methods and procedures used in this evaluation are essentially the same as those used by Cole[3/] in sampling mountain pine beetle.

Two trees from each of four diameter classes will be sampled on the Flathead, Gallatin, Helena, and Lewis and Clark National Forests. Diameter classes will consist of <9, 9 to 12, 12 to 15, and >15 inches d.b.h. To estimate the Douglas-fir beetle population, a 1/10-square foot[4/] bark sample will be taken with the use of a ladder, a hand ax, and a chisel at two randomly selected sample locations approximately 9 to 15 feet above the ground; and a companion 6- by 12-inch sample will be used to inventory parasites and predators.[5/] A simple method for randomly selecting a sample is to place 16 code numbers on separate ½-inch squares (embossed tape) in a vial and shake out two of the squares. Printed on each square will be the cardinal directions; i.e., N1, N2, N3, N4 . . . W1, W2, W3, W4. There are four possible sample locations for each cardinal direction. A total of four diameter classes, eight trees, 32 samples, comprise a sample. One sample will be taken for each beetle generation.

Observation times and type of data to collect are as follows:

3/ Cole, Walter E. The mountain pine beetle in lodgepole pine (Dendroctonus monticolae Hopk.) (Coleoptera: Scolytidae). A systematic random sampling plan for life tables and their analysis. Intermountain Forest and Range Expt. Sta., Forest Service, Ogden, Utah. 1965.

4/ Furniss, M. M. A circular punch for cutting samples of bark infested with beetles. Can. Ent. 94: 959-63. 1962b.

5/ Furniss, M. M. Personal communication. 1968.

1. NE = egg density (May-June). The first observation will be taken when the flight and attack period of the parent adult beetle is completed, and the majority of egg deposition accomplished. Data needed from this observation are:

a. Number of attacks.

b. Number of egg niches and larval starts.

c. Number of small larvae.

d. Length of egg gallery.

2. N_1 = Small larval sample (June). This observation will account for additional attacks and egg deposition and small larval density.

3. N_2 = Large larval population (July-August). Large larval and pupal densities are included in this observation.

4. N_3 = Pupal and callow adult densities prior to winter (October). This observation should be taken as close to the onset of winter as possible.

5. N_4 = Brood density immediately post-winter (April). This observation will determine winter kill, and will include callow adults, some large larvae, and pupae that resulted from the second attack period. It will be necessary to cage each sample tree for emerging adult beetles. Data recorded from cages are: number of new adult beetles, adult parasites and predators. Caging is done by stapling a 6- by 12-inch funnel-shaped plastic saran cage with an attached glass vial trap at two randomly selected sample locations.

N = the population density of the Douglas-fir beetle for the thirty-two 1/10-square foot samples for all diameter classes. Four life tables will be constructed during each observation, at each plot--one life table for each diameter class. Data will be collected in a uniform procedure and at specific times during the generation year.

Additional Data to be Recorded

Parasites-predators.--The biotic organisms must be measured in order to gain insight and more clearly define the reasons for change within a population. It is important to record number and kinds of parasites and predators present at the time of sampling.

Additional attacks and brood.--If, during the course of the generation year parent adults extend galleries, resume egg deposition, or reattack and deposit eggs, these data will be recorded.

Data will be recorded on Unisort Analysis Card (S&PF form 59-5230-11, fig. 1).

Infested tree data.--The ratio of new to 1-year-old attacked trees will be counted annually in each plot each October. The number of newly attacked standing green trees resulting from beetles that developed in blowdown will also be recorded as it occurs within an infested area.

Time and manpower required.--Ten man-days are needed to sample one generation. The following stages will be sampled:

1. Eggs and small larvae.

2. Large larvae.

3. Pupae and callow adults.

4. Emerging adults (collecting cage data).

Analysis of data.--Data will be analyzed by regressions to determine if any one brood stage, attacks per square foot, or other biological data collected during this study can be correlated with the number of new attacked trees by d.b.h. in the stand. Cooperation will be maintained with entomologists at the Intermountain Forest and Range Experiment Station in Ogden, Utah, and Moscow, Idaho, for analyzing data.

Equipment.--Adequate supplies are available for completion of the study, and no new equipment is needed.

59-5230-11

DATA SHEET
BIOLOGICAL EVALUATION BARK BEETLE INFESTATIONS
(Reference: FSM 5230)

Date _____

Observer _____

Insect _____ Host _____

Forest _____ Unit _____
(only for control units)

Location _____
(name drainage and give other pertinent location data)

Size of infested area _____ acres. Number infested trees _____
(your estimate)

Elevation _____ Exposure _____
(altimeter or approximate) (N., S., E., W., or flat)

Overmature _____ Mature _____ Poles _____ Reproduction _____
(ocular estimate in percent to total 100 percent)

Average d.b.h. _____ Stand composition: Pure _____ Mixed with _____
(host type) (within the infested area)

Position in stand of infested trees: _____
(groups, singles, scattered, concentrated)

Percent of stand: Infested _____ Killed _____
(brood trees) (killed this outbreak)

Buildup ratio: Red tops _____ to new attacks _____

Pitchout ratio: Pitchouts _____ to new attacks _____

Remarks: _____

UNISORT ANALYSIS CARD FORM Y9 BURROUGHS CORPORATION - TODD DIV. - L HADLEY PRINTED IN U.S.A.

Insect data: One 6- by 6-inch sample taken for brood data; same sample opened (vertically) to 6 by 12 inches for starts and gallery inches; two samples on 10 trees at breast height taken on opposite sides of the tree.

No. sample	D.b.h.	Side	6- by 6-inch sample																				6" by 12"		Reference No. for remarks* (i.e., 1/, 2/
			Eggs		Larvae		Pupae		Adults		Total brood		Parasites and predators										Gallery starts	Inches gallery	
			L.	D.	L.	D.	L.	D.	L.	D.	L.	D.	Clerid	Temnochila	Othniide	Histerids	Medeterus	Coeloides	Staphylinids	Tenebrionids					
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									
Total																									
Av./Sq. Ft.																									
Percent mortality																									

Conclusions: (Circle) Present condition: (epidemic, endemic, static) Trend: (increasing, decreasing, static)

*Remarks: _____